# BOTANY FOR NOVICES:

A SHORT OUTLINE OF

## THE NATURAL SYSTEM

OF

## CLASSIFICATION OF PLANTS.

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# PREFACE.

THE following little book is intended for the use of those persons, who, while wishing to know something of Botany, feel deterred by the long words and apparently formidable difficulties which meet their perplexed gaze on opening an elaborate treatise on the subject; or who entertain the groundless fear that they cannot learn much of the science without burdening the memory with a great many long, hard names of plants, which will leave them, after the trouble

of learning them, little wiser than before. Let such be assured, that without needing to trouble themselves with any other names than the sweet familiar ones they have known from infancy, they may learn the principles of the science, which have reference, not to the names, but to the structure of the plants, and are to be acquired by a careful examination of living specimens, guided by a few simple rules of classification. We know that "a Rose by any other name would smell as sweet," and if we wish to determine the class to which to refer a Honeysuckle, we can examine the flower with equal care and attention, whether we call it "Honeysuckle," or "Lonicera Periclymenum." This latter certainly sounds formidable enough to a

beginner, but when the principles of the science are understood, and the reason for the long names becomes apparent, they cease to appear difficult or alarming. In the little book before us, however, we do not proceed so far as the naming of individual plants, it is simply an attempt to explain the principles of the Natural System of Classification, established by Jussieu, De Candolle, and others, and adopted, with more or less modification as to detail, by most modern botanists. Many persons have an impression that the Artificial system of Linnæus, though confessedly grouping together plants of the most incongruous character, yet possesses greater facilities of reference—that it is easier for a beginner to find out the name of a plant by it

than by the Natural system. It is hoped, however, that the readers of this little book will find that it is quite as easy to refer an unknown plant to its appropriate class and sub-class, and thus to know in what part of a manual of plants arranged on the Natural system, to seek for its name and description, as it is to determine the Linnean class and order. And with this great advantage, the Linnean class and order in many cases reveal nothing whatever of the affinities of the plant, whereas to state that a specimen belongs to any one class, or natural order, decides that it must possess a certain definite structure.

The few botanical terms this little book contains are carefully explained as they occur, and as they are seen to possess a meaning, containing

within themselves a short definition of the classes to which they are applied, it will be found that, far from offering difficulties, they afford material assistance to a beginner, as they help to fix the characters of the classes in the memory.

This little book is adapted for the use of those who have no previous acquaintance with botanical science, but it has been written in the hope that it may introduce its readers to a more extended study of the subject.

JANUARY, 1864.

# BOTANY FOR NOVICES.

## CHAPTER I.

THE first broad distinction in the vegetable kingdom, is, that between plants which bear flowers and seeds, and plants which do not bear flowers, nor true seeds.

With the flowerless plants, we have, on the present occasion, little to do, except to point out a few examples of them, in order that the differences between them and the flowering plants may be appreciated. We do not propose to enter into the details of distinction between the different classes into which they are arranged, but merely to name a few of them, which every one will recognise; namely, Ferns, Mosses,

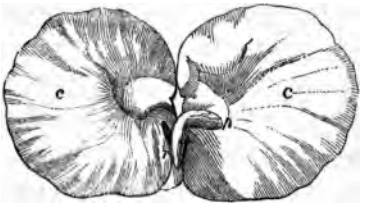
Fungi, and Sea-weeds. We will therefore leave the flowerless plants for the present, and proceed to that which is more specially the object of this little work.

Flowering plants are divided into two grand *classes*, founded on distinctions in the seed. These distinctions are most conveniently observed in plants which produce large seeds, such as beans, nuts, and wheat.

But the distinctions in the seed are correlated to such striking differences in the general structure and appearance of the plant, that it is easy, by observing these differences, to place the plant in its proper class, without dissecting the seed. This, as most plants bear small seeds, would be tedious or impracticable for beginners unaided by a good microscope.

In order to comprehend the important character on which botanists found their division of flowering plants into two grand classes, let us examine the seed of the common bean. On peeling off the outer skin, the bean will readily split into halves, connected only by the germ which

would have developed into the young plant. If, instead of dissecting the bean, we had planted it, the two halves of the seed would have assumed a leaf-like character, and, in fact, formed the two seed leaves of the plant, between which the future stem would have shot up.




*cc* Cotyledons of the bean. *r* Radicle or root.
*p* Plumule or future stem of the plant.

These lobes of the seed, or seed leaves, are termed *Cotyledons.*

Had our seed been that of a Lupine, we should have seen the cotyledons appearing above ground in the form of two roundish thickened wrinkled seed leaves, presenting a striking contrast to the slender palmate stem leaves we all recognise as those of the Lupine. These are

developed before the seed leaves wither and fall off, which they do as the plant advances towards maturity.

The cotyledons of the pea form the "split pease," of commerce. The cotyledons of the hazel nut, or of the filbert, may be easily observed by peeling the kernel, when it will readily split into the two lobes or cotyledons which form it. They may also be seen in the walnut, but as each cotyledon is deeply lobed, and they adhere more firmly together than the common nut, they are not so readily recognised. In seeds which are too small to dissect conveniently, the cotyledons may be observed by sowing them in fine earth, and watching the seed leaves when first they burst above the soil.

Plants bearing seeds which have two seed lobes, or cotyledons, form the first of the two grand Classes into which flowering plants are divided. They are termed *Dicotyledons*, from "dis," a prefix denoting double, and "cotyledon," seed lobe.

But if we take a grain of wheat, we shall in vain endeavour to split it into two cotyledons. In fact there is only one. Embedded within the farinaceous matter which forms the substance of the grain, lies one solitary cotyledon. Consequently, the young plant springs with only one seed leaf.

Plants bearing seeds which have only one seed lobe, or cotyledon, form the second of the two grand Classes into which flowering plants are divided. They are called *Monocotylēdons*, from "monos," single, and "cotylēdon," seed lobe.

In these two grand classes—Dicotyledons and Monocotyledons—all flowering plants are arranged.

A third grand class is formed of the flowerless plants.

As these plants do not produce flowers, they cannot bear true seeds, and therefore, of course, can have no seed lobes. They are propagated by means of *spores*, a granular powder like fine

dust, which germinates in a manner altogether different from true seed.

As they have no seed lobe, this class of plants has received the name of *Acotyledons:* "A" meaning without, and "cotyledon," seed lobe. The Acotyledons, or plants without seed lobes, form the third grand Class in the Natural System of Botany.

Of these three classes of plants—Dicotyledons, Monocotyledons, and Acotyledons, the Dicotyledons are the most highly organised. They are the crown of the vegetable kingdom, and form the great majority of species, especially in temperate climates, at the present epoch in our world's history.

As far as the geological record has been hitherto interpreted, the Dicotyledons appeared latest in the succession of vegetable forms of life. The earliest traces of vegetable existence shew flowerless plants, or Acotyledons, such as Seaweeds, Ferns, &c. The next class to make their appearance on this world's stage, are the

Monocotyledons, and, last of all, come the Dicotyledons.

Before proceeding farther, let us recapitulate, in order to fix the distinctions of the classes in the memory, that the term Dicotyledons means Plants with two seed lobes; Monocotyledons, Plants with one seed lobe; and Acotyledons, Plants without seed lobe.

In order to appreciate the great differences in structure and appearance which characterize the two grand *classes* of flowering plants, already defined by the construction of the seed, let us procure, as illustrations of the class Dicotyledons, a young shoot of a forest tree, Horse chesnut or Sycamore, and an herbaceous plant, a Buttercup or Lupine; and of the class Monocotyledons, a Lily or Hyacinth, a Cane, and a plant of Grass.

With a sharp knife, cut across the shoot of Horse chesnut, and observe the section of the branch. In the centre is the *pith*, round this is the newly-formed wood, and the bark encloses

the whole. If the spray had been allowed to grow a second year, there would have been a fresh ring of new wood formed on the outside of the first. This may be observed by cutting across a shoot of two years' growth. Every year that the tree grows, it forms a fresh ring of new wood on the *outside* of the old wood. When a large tree is sawn across, the rings of growth are very perceptible, and it is often possible, by counting them, to determine the age of the tree.

Section of a branch of Horse Chesnut of one year's growth.


Vertical section of a shoot of Horse Chesnut of one year's growth.

*a* Medulla, or Pith.
*b* Medullary sheath from which the rays proceed.
*c* Woody fibre.
*d* Liber, or inner bark.
*e* Outer bark.

In addition to the rings of growth, another set of marks is observed in the stem of a Dico-

tyledonous plant. This is an appearance of *rays*, proceeding from the pith in the centre to the bark at the circumference, resembling the spokes of a wheel. This is not readily perceived in our young spray of Horse chesnut, but if we cut across a small branch of Beech about the size of a thin quill, we shall see the rays very distinctly.

Section of a branch of Beech of four years' growth.

The stem of a dicotyledonous plant presents, then, the following peculiarities. It has a central pith, surrounded by successive concentric rings, each representing one year's growth, with a bark enclosing the whole. As each ring of growth is added on the outside of what was formed before, it is evident that the wood of the stem of a dicotyledonous plant is *youngest at the circumference.* In other words, the plant grows on

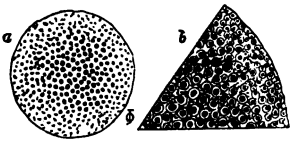
the *outside.* This is expressed, in botanical language, by the term *Exogen*—"Exo" means out, or outside, and "gen" expresses generation, or growth. The term *Exogen* may be translated, "outside grower."

Now all plants having *two seed lobes,* have also stems which grow on the *outside.* In botanical language, all *dicotyledonous* plants are also *exogenous.* The words dicotyledonous and exogenous, though having reference to totally different parts and peculiarities of the plants—the one referring to the seed, and the other to the stem—yet serve equally well to define the first grand Class in the Natural System of Botany. And in speaking of the Class collectively, we shall be equally correct in terming them either Dicotyledons or Exogens.

Though we have adopted a plant with a woody stem as the most convenient illustration of exogenous growth, it must not be supposed that all Exogens are woody. Many of them are herbaceous plants, but as their stems usually

die down every year, the concentric rings of growth cannot be formed.

Let us now observe the structure of the stem in monocotyledonous plants. We cannot have a better illustration than a common cane. On cutting it across, no trace is perceptible of a pith, of concentric rings, nor any appearance of rays. The section exhibits a uniform character throughout. The new cells form




Section of a cane—Endogen.
*a* Natural size. *b* Portion enlarged.

in the centre of the stem, they press out the older ones, which become squeezed together. Consequently the wood is most consolidated, hardest, and oldest at the circumference of the stem. This is precisely contrary to what takes place in exogenous growth. Plants which grow from the *inside,* are termed *Endogens,* from

"endŏn," within, and "gen," from a Greek word, expressing generation or growth. The word Endogen, may therefore be translated, "inside grower."

All plants which have only *one seed lobe*, have also stems which grow in the *inside*. In botanical language, all *monocotyledonous* plants are *endogenous*.

The words monocotyledonous, and endogenous, though referring, the one to the seed, and the other to the stem, serve equally well to define the second grand Class in the Natural system of Botany. And in speaking of the Class of plants collectively, we may at pleasure term them either Monocotyledons or Endogens.

The *leaves* of the two grand Classes of flowering plants, Dicotyledons, or Exogens, and Monocotyledons, or Endogens, are characterized by distinctions quite as marked as those which define the stems, and they are even more easily observed. Hold up to the light, with one hand a leaf of Sycamore or Horse Chesnut, or

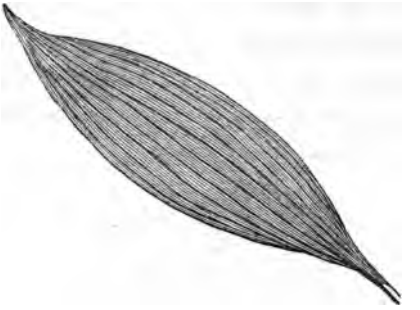
any forest tree, and with the other a broad blade of Grass. On comparing the two, it will be seen that in the leaf of the tree, the veins, or nerves of the leaf, branch out into innumerable ramifications, which interlace each other in every direction, so as to form an interminable and complicated network. In the blade of Grass, on the contrary, the veins remain parallel throughout their whole course, and never once interlace from end to end of the leaf.


Net-veined Leaf.—Black Currant. Exogen.
The half marked *a* has only the ribs and larger veins shown, but *b* has the smaller ones as well.

Dicotyledonous plants, or Exogens, whether

woody or herbaceous, are characterized by having leaves with *netted veins.*

Monocotyledonous plants, or Endogens, are characterized by having leaves with *parallel veins.*



Leaf of Lily of the Valley. Parallel Veined Endogen.

It is said that exceptions prove a rule, and these assertions must be taken subject to two exceptions. There is a tribe of Exogens, the *lowest* in their class, which consists of plants having leaves with parallel veins. This is the Pine or Fir tribe. This tribe is very remarkable in other particulars, but this is not the place to enter on its peculiarities.

The other exception is that of a small subclass of Monocotyledonous plants, the *highest* in their class, consisting of plants having leaves with netted veins. These will be noticed further on, when we come to speak of the classification of Endogens.

## CHAPTER II.

BEFORE proceeding further in the classification of plants, it is necessary to learn the parts, or organs, of a flower.

The flower is formed of four rows, or whorls, of metamorphosed leaves, set one within another. These four sets of organs are named, beginning from the outside,

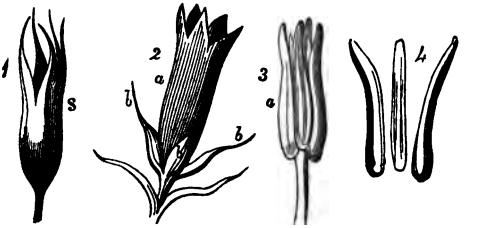
1. The Calyx.
2. The Corolla.
3. The Stamens.
4. The Pistil.

The last two, the Stamens and the Pistil, are essential organs of the flower. Both are necessary for the production of seed, but it is not requisite that both should grow in the same flower.

The first two, the Calyx and the Corolla, are termed the floral envelope; they surround and

protect the essential organs, viz., the Stamens and Pistil, but they are not necessary for the production of seed, and are not always present. Some kinds of flowers have neither calyx nor corolla, and others only one of these organs.

Let us examine a flower which has all four sets of organs well developed. The common single Wallflower, or Stock, will afford us an excellent illustration.




Calyx.

1. Gamosepalous—Primrose. *s* United sepals
2. Gamosepalous with bracts—Sweet William. *a* United sepals. *b* Bracts.
3. Polysepalous—Stock. *a* Sepals not united.
4. Sepals shown separately.

The outer envelope of the flower consists of four narrow upright leaves, which enclosed the

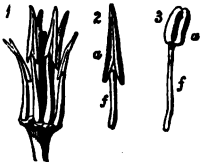
bud before it expanded, and which now form the cup of the flower. This is the *Calyx*, or flower-cup. The leaves, or divisions of the calyx, are called *Sepals*, they may be distinct, as in the Wallflower, or united by their edges into a tube, as in the Pink. The calyx is usually green.

Next come four large, coloured, spreading leaves which form the *Corolla*. The corolla is usually of gay colours, and forms the most conspicuous and ornamental part of the flower. The divisions, or leaves of the corolla, are termed *Petals*. The petals may either be distinct, as in the Wallflower and the Rose, or united by their edges into one, as in the Convolvulus.

Polypetalous Corolla of Stock; petals distinct.

The next row consists of six objects which

we shall not readily recognise as leaves. They are the *Stamens.* Each stamen is formed of a stalk, or *filament,* and a head, or *anther.* The filament corresponds to the stalk of a leaf, and the anther to the leafy portion, but so transformed that we have at first some difficulty in believing the stamen to be analogous to a leaf. The anther has two cells containing a granular powder termed *Pollen.* When the stamen is ripe, the anther-cells burst, and the pollen escapes. Every one is familiar with the abundant yellow pollen of the Lily.



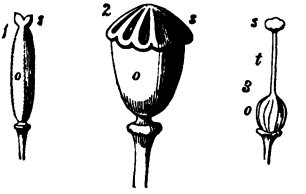

Stamens.

1. Stamens of Stock. 2. A stamen separate.
3. Stamen of Poppy. *a* Anther. *f* Filament.

The centre of the flower under examination is occupied by an oblong green body, about as

high as the stamens. This is the *Pistil.* The pistil consists of three parts: the *germen* or *ovary,* the *style,* and the *stigma.* The germen, or ovary, is a thickened expansion forming the base of the pistil. It contains *ovules,* which are destined ultimately to develope into seeds. It becomes, when ripe, the *Fruit* of the plant. From the germen rises the *style,* or middle portion of the pistil. This is crowned with the *stigma,* a kind of head with a sticky or viscid surface. In the Wallflower the germen forms the greatest portion of the height of the pistil, the style is short, and the stigma has two lobes. But if we examine the pistil of a Primrose, we shall see that the germen is short, and round, the style long and thread-like, and the stigma rounded like the head of a pin. There may be one or more pistils in a flower, and they vary greatly in size and construction in different classes of flowers. The ovary and the stigma are essential parts of the pistil, but the style is sometimes wanting. In this case the stigma is seated directly on the germen,

as in the Poppy. The pistil, like the stamens,




1. Pistil of Stock. *s* Stigma. *o* Ovary.
2. Pistil of Poppy. *s* Stigma. *o* Ovary.
3. Pistil of Primrose. *s* Stigma. *t* Style. *o* Ovary.

is formed of leaves so curiously metamorphosed and folded together, that we can with difficulty recognise them as such. The pistil is an essential part of the flower, and always occupies its centre—that is, when the flower contains pistils. Though both these organs are necessary to produce seed, they do not always exist in the same flower, or even on the same plant. Flowers which have stamens only, or pistils only, are termed unisexual, or imperfect; flowers which have both these organs are termed hermaphrodite, or perfect. At the period of flowering, when the stamens are ripe, the anther

cells burst, and the pollen falls upon, or is conveyed by the agency of insects to, the stigma. It is there retained by the viscid surface. Each grain of pollen then puts forth a minute tube, which pierces the surface of the stigma, penetrates the tissue of the style, and is guided to the ovules, to which it communicates the principle of life. The stigma, having fulfilled its office, then withers, the flower falls, the germen swells and ripens into the fruit, the seeds mature, and in due time the capsule containing them opens for their dispersion.

The four rows of metamorphosed leaves forming the flower are inserted into the end of the flower stalk. This is called the *receptacle*, or *Thalamus*, and may be compared in function, though not in form, to the cork in a shuttlecock. If we imagine a shuttlecock with four rows of feathers of different shapes, sizes, and colours, we shall have a rough notion of the arrangement of the parts of a flower, which will serve as a basis for explanation of the distinctions on which the sub-classes are founded. Let us imagine the

first, or outermost row, small and green, to represent the calyx; the second row large and gaily coloured to represent the corolla; the third row of long slender quills, with only a little feather at the top, will stand for the stamens; while the pistil may be represented by three or four feathers standing in the middle, joined by their edges into a kind of box or capsule, or each feather folded up singly so as to imitate a pod, with, in either case, seeds growing where the edges meet.

The number of divisions in each floral whorl is a point of great consequence in classification. In dicotyledonous plants this number is usually either *five*, or a multiple of five, or *four*, or a multiple of four. Flowers which have five as the primitive number of divisions in a whorl are said to have *quinary symmetry*. Flowers which have four as the primitive number are said to have *quaternary symmetry*. As an example of quinary symmetry, let us examine the "Ragged Robin" (Lychnis Flos-cuculi), so common in the meadows in June. The sepals are *five*, united

by their edges into a tube; the petals are *five*, the stamens are ten, or *twice five*, and the pistils are *five*.

As an example of quaternary symmetry take the Fuschia. The sepals, which in this flower are coloured, and longer than the petals, are *four*, the petals are *four*, the stamens are eight, or *twice four*, and though there appears to be but one pistil, it is in reality four joined together, for the stigma has four lobes, and the ovary four divisions.

But all plants are not so regular in their formation as these. Frequently the number of divisions in one or more whorls is multiplied indefinitely, while other whorls retain the primitive number. In the Buttercup the calyx has five sepals and the corolla five petals, while the stamens and pistils are each increased to an indefinite number. In other plants some of the divisions are suppressed or wanting. In the Snapdragon the quinary symmetry of the flower is marked only by the calyx, which has five sepals. The petals are united into a tubular,

irregular, fantastic corolla, and there are only four stamens. An abortive fifth stamen, however, sometimes makes its appearance in this plant.

One other point in connection with the floral whorls remains to be noticed, and can be best explained by recurring to our imaginary shuttlecock. The feathers representing one whorl are not usually set *opposite* the feathers of the preceding whorl, but *alternate* with, or opposite the spaces between them. When two succeeding whorls appear with their divisions opposite, which is sometimes the case, it may be assumed that an intermediate whorl which formerly existed has come to be suppressed. Thus apparent irregularities may often, by careful examination, be reduced within general rules.

## CHAPTER III.

THE two grand classes of flowering plants—Dicotyledons and Monocotyledons, are each divided into sub-classes, founded on various points of distinction. The class of Dicotyledons, or Exogens, is divided into four sub-classes; that of Monocotyledons, or Endogens, into three. We shall devote this chapter to an examination of the characters which define these seven sub-classes.

As we have just stated, the first class, that of Dicotyledons, or Exogens, contains four sub-classes. These are founded on distinctions in the structure of the flowers.

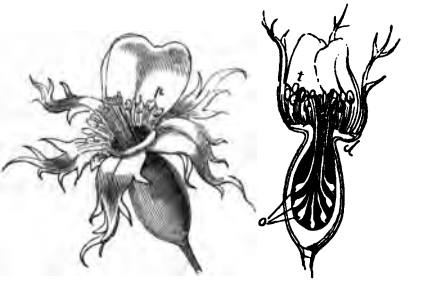
The first sub-class of Dicotyledons consists of plants which have their stamens inserted into the *Thalamus*, or receptacle. Our imaginary shuttlecock, as we have hitherto considered it,

with four whorls of feathers inserted in the cork, regularly one within the other, represents the flowers of this sub-class of plants with sufficient accuracy for our present purpose. But in order to arrive at a clearer idea of the actual structure of the flower, let us take a Buttercup and split it up with a fine needle through the centre of the stalk and the receptacle, so as to divide the flower into halves. By examining the section thus obtained, we shall see how each floral whorl is inserted, and especially mark that the stamens grow beneath the pistils on the receptacle or thalamus.

Plants which have their stamens inserted into the receptacle, form the first sub-class of Exogens, and are termed *Thalamifloræ*—Thalamus meaning receptacle, and floræ, in this connection, denoting stamens. The word Thalamifloræ may therefore be said to mean "receptacle flowerers."

Examples of the sub-class Thalamifloræ—Buttercup, Clematis, Wallflower, Violet, Pink, Mallow, Geranium, Water Lily, Mignonette.

The second sub-class of Dicotyledons consists of plants which have their sepals, or leaves of the calyx, united by the edges, so as to form a kind of cup; and their stamens inserted on the inner surface of this cup, instead of growing directly on the receptacle. To represent this



Calyx of a Rose, with the Stamens inserted in the Disk. Petals, except one removed.
*a* Stamens. *o* Ovaries. *s* Styles. *d* Disk.

state of matters on our imaginary shuttlecock, let us fancy the outer row of small green feathers which stands for the calyx, joined by the edges of the feathers into a cup—and the second and third rows, representing the petals and the stamens, standing on the feathery part of the

outside row, instead of sticking in the cork. The stamens spring from the inner surface of the calyx, just at the root of the petals, and form a ring inside them.

Plants which have their stamens inserted into the calyx, form the second sub-class of Exogens, and are termed *Calyciflorœ*—that is, *cup flowerers*, as they bear their stamens on the calyx, or cup.

Examples of the sub-division Calycifloræ—Rose, Strawberry, Saxifrage, Stonecrop, Houseleek, Pea, Acacia, Hemlock, and Ivy.

Plants of the third sub-class of Dicotyledons are distinguished at a glance from those of the two former classes, by a very striking and obvious characteristic. Both thalamifloral and calycifloral exogens have a corolla consisting of a row of distinct petals, each inserted separately, on the receptacle, or calyx, according to the class to which they belong. But in the plants now under consideration, the petals, instead of being distinct, are joined into one by their edges. They are merged or "married" together, so as

to form one compound petal. The corolla, thus transformed, is termed "gamopetalous," from the Greek word "gamos," "marriage." The "mar-

Gamopetalous corolla of Convolvulus. Petals united.

ried petals," thus united, bear the stamens on their inner surface.

The gamopetalous corolla assumes various forms—it may be a goblet, as in Heath; a bell, as in Hair-bell; a tube, as in Woodbine; a wheel, as in Pimpernel; or a narrow tube, crowned with a flat expansion at the summit, as in Primrose, Verbena, and many other flowers. But whatever form it takes, it has invariably the

stamens attached to it; and if it be pulled away from the receptacle, the stamens will come with it.

Plants which have the stamens inserted on the corolla form the third sub-class of Exogens, and are termed *Corolliflorœ*, that is, "corolla flowerers."

Examples of the sub-class Corolliflorœ—Heath, Rhododendron, Primrose, Honeysuckle, Salvia, Foxglove, Snapdragon, Daisy, Hair-bell, Gentianella, Potato, Nightshade, Verbena, and Forget-me-not.

The fourth sub-class of dicotyledonous plants is founded on a character independent of the insertion of the stamens. To make our imaginary shuttlecock represent it, we must pull out of it the second whorl of feathers, that which stands for the corolla, and leave it shorn of its gayest part, with only calyx, stamens, and pistil. And in some cases the calyx too is wanting. Hence the sub-class is termed *Monochlamydæ*, from "monos," single, and "chlamys," covering—or

*Apetalæ*, from "A," a prefix denoting without, and "petal." The flowers of this sub-class are small and inconspicuous compared to others, they are frequently united into spikes and catkins, as in the Willow and Hazel, or into cones, as in the Pine and Fir tribe.

Examples of the fourth sub-class of Exogens, Monochlamydæ, or "singly covered"—Dock, Nettle, Hop, Spurge, Oak, Willow, Hazel, Pine, and Fir.

Recapitulation of the four sub-classes of the class Dicotyledons, or Exogens:

1. Thalamifloræ. Plants with flowers having the stamens inserted into the Thalamus.

2. Calycifloræ. Plants with flowers having the stamens inserted into the Calyx.

3. Corollifloræ. Plants with flowers having the stamens inserted into the Corolla.

4. Monochlamydæ. Plants with flowers having the floral envelope single, or wanting.

We now enter on the second grand class of flowering plants, the Monocotyledons, or Endo-

gens. As we descended the vegetable scale, through the four sub-classes of dicotyledonous plants, we arrived in the fourth sub-class, Monochlamydæ, at a stage when the floral envelope was no longer distinguishable into calyx and corolla, and now that we come to the second class of plants, we find a somewhat similar order of things prevailing. In most endogens the two outer whorls of the floral envelope are alike in character, so as to form apparently only one appendage. This is termed the *Perianth*, from "peri," about, and "anthos," flower.

In monocotyledonous plants, the primitive number of divisions in the floral whorls is usually *three*, consequently the flowers are said to have *ternary symmetry*. The Lily is an admirable type of the flower of a monocotyledonous plant. The perianth is six-parted—the divisions arranged in an outer and an inner whorl of three in each. This arrangement gives the flower a somewhat triangular outline. There are six, or *twice three* stamens, the stigma has three lobes, and the seed vessel three cells,

completing the ternary symmetry of the flower.

Lilium lancifolium.

Amid the widely diversified forms which monocotyledonous plants assume, there is a general similarity of character and texture, which serves to mark them off clearly from the exogens, even to an observer who has not entered into the technical definitions which form the basis of scientific classification. The leaves of exogens have a more compact and wiry texture, and usually feel drier and warmer to the touch than those of endogens. There is a cold

clammy feeling on touching many of the latter, difficult to describe, but which will be understood on taking hold of the leaves of the white lily, and then of a horse chesnut or of a bunch of any common herbaceous plant. The leaves of exogens are usually dull, when not hairy or downy, the leaves of endogens are most frequently smooth and shining. It is difficult to tear straight through the leaf of an exogen, it is easy to make ribands of the leaf of an endogen, by tearing in the direction of the veins. The leaves of exogens are often toothed or serrated at the edges, the leaves of endogens almost always smooth.

The above distinctions will not apply universally in comparing exogens and endogens, but in spite of frequent exceptions the general character holds good, and when once the attention has been roused to the great distinction between the two classes of plants, it will be seen that the definitions of the botanists, instead of representing dry technical differences, intelligible and

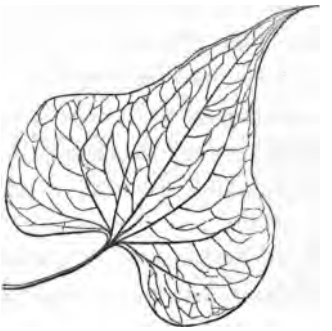
interesting only to learned professors, embody real living distinctions, obvious to the eye and the imagination of every one who will look for them, and simple enough for any child to understand, when once they are pointed out.

Monocotyledonous plants, as we stated at the beginning of this chapter, are divided into three sub-classes.

The first two of these have the floral envelope still formed on the shuttlecock pattern, or *whorled.*

The first sub-class of monocotyledonous plants is termed *Dictyogenæ,* from "dictyon," a net, "gen," expressing growth. The name may therefore be translated "net growers." It consists of endogenous plants having leaves with *netted veins.* But although in this particular they resemble the class above them, the exogens, yet the character and general appearance of the plant sufficiently distinguishes them, and there is little danger, though both have netted

veins, of mistaking a leaf of one of this class of plants for that of an exogen.



Black Bryony. *Tamus Communis.* Net-veined endogenous leaf. Sub-class—*Dictyogenæ* or *Retosæ.*

This exceptional and curious class of net-bearing endogens includes only five natural orders, and about three hundred species, of the plants distributed over the whole world. The extreme smallness of this proportion will be understood when it is stated that the seven sub-classes of flowering plants include about two hundred and sixty-six natural orders or tribes, and that the largest of these tribes contains be-

tween nine and ten thousand, and several others between four and five thousand known species.

There are but two species of the sub-class Dictyogenæ found in Britain, but the individual plants are numerous and widely distributed. Few that have ever walked in a country lane can have failed to mark the elegant Black Bryony spreading its shining leaves and scarlet berries in graceful profusion over the hedges. But, while wondering at its beauty, our interest is heightened by knowing that most of its congeners are tropical species, and that it is the representative of a very small sub-class of plants, presenting in their structure, characters that seem to unite the two grand classes of Exogens and Endogens.

If we wished to illustrate the difference in texture and general appearance between these two classes of flowering plants, we could not do better than compare the Black Bryony with the great Bindweed (Convolvulus Sepium).

The habits, manner of growth, and shape of the leaves are not very dissimilar, a careless

observer might possibly mistake one for the other, yet if the two plants are compared, the Convolvulus is seen to be like other Exogens in the dull look and comparatively close, wiry texture of its stems and leaves, while the Black Bryony, in spite of its netted veins, has the less firm texture, shining leaves, and cold clinging touch which characterise Endogenous plants.

The Yam, an important article of food in tropical countries, belongs to this sub-class, and is nearly allied to the Black Bryony, as is likewise the Chinese Potato (Dioscorea batatas), which was sought to be introduced into this country as an esculent. The leaves of this latter plant bear a remarkably close resemblance to those of the Black Bryony. In size of the tuber it is not to be compared to our native plant, whose roots seem of amazing and portentous magnitude to the unsuspecting young botanist who tries to dig one up. They have tuberous masses attached to them, as thick as a man's arm,

and long enough to defy all efforts with a mere spud to secure them without breaking. But their good qualities are not in proportion to their size.

The other British representative of the first sub-class of endogens is perhaps not quite so common as the last, but may be frequently met with in damp woods. It is the Herb Paris, or True Love, a curious plant about a foot high, with four leaves arranged in such a form as to suggest the figure called a True Lover's Knot, whence its name, and a solitary green flower on a slender stalk, changing to a purple berry. The netted veining of the leaves is sufficiently conspicuous, and, unlike most endogens, the flower has quaternary symmetry, yet, as in the case of the Black Bryony, the endogenous character of the plant can hardly be mistaken on examination. The flower has the peculiarity of bearing its anthers, not on the ends, but in the middle of the filaments, which project above them as sharp spikes, giving the flower an odd, weird look.

There is something startling in coming unexpectedly on a bed of these singular plants amid the common flowers of the woods in Spring, they look half alive, as if a swarm of sprawling insects were hovering over a carpet of green leaves. They are not conspicuous from a distance, and well as we know the plants, we never become suddenly aware that we have walked into the midst of a patch of them, without feeling that we have lighted on something new and strange. Far from being content with having correctly ticketed them with their name, class, and order, and then imagining that we know all about them, we cannot resist the charm with which their singular form and anomalous character invests them in our imagination, nor help the thought, that, concealed within the structure of an humble weed such as this, could our eyes but be opened to read rightly the indications presented to us, lies the key to the great mystery of the origin of the forms of animated beings. In nature, nothing is trivial or unimportant, the smallest and most ephemeral of beings, owes its origin to the

working of the same laws, and the force of the same Power that produces the greatest and mightiest on the earth. Newton found the law of gravitation in the fall of an apple. The Newton who may reveal as clearly the law which produces the varieties of living forms, as his predecessor did that which rules the motions of the stars, may possibly find the clue in studying the structure of a wayside weed, or a microscopic fungus. In the glory of this enterprise every faithful, reverent student of nature may hope to share. That the law will be eventually discovered there is little need to doubt—that it will be done by the unaided efforts of one man is scarcely possible. Every accurate observer who records a new fact, every patient watcher who traces the working of an obscure law of nature, contributes a brick to the great pyramid, from the summit of which, the genius to whom the lot shall fall, may one day proclaim to the world the solution of the mystery of life.

This may be thought a digression from the

immediate object of this little work, but it is not foreign to its main purpose, which is to awaken a love of nature for its own sake, to stimulate minds to original research, and to remove any impression that the study of science consists in learning what others have done, instead of making use of the labours of those who have gone before us, to advance further on the path they have cleared. With regard to our immediate subject, it must be borne in mind that Botany means the knowledge of living plants, not the knowledge of what men have written about them. He who uses the plants to help him to understand the books that he reads, instead of using the books to help him to understand the plants that he sees, may make a clever pedant, but not a philosophical naturalist.

The veining of the leaf is so far a trustworthy guide as to the class in which to place a plant, that should the young botanist be examining any British species which has netted veins, and is neither Black Bryony nor Herb

Paris, he may unhesitatingly class it as an Exogen. It will now be easy to remember that the first sub-class of Endogens comprises plants which have the striking peculiarity among Monocotyledons, of leaves with netted veins, hence their name of net-growers, or Dictyogenæ.

Examples of the sub-class—Herb Paris and Black Bryony.

The second sub-class of Monocotyledons consists of plants with leaves having parallel veins, and flowers with the perianth whorled. It is termed *Floridæ*, or *Petaloidæ*, and both these names are appropriate, as the perianth is usually of a petaloid character, and the sub-class includes all monocotyledonous plants which have conspicuous or gaily coloured flowers. It is not, however, confined to these: many of the Floridæ, as the Rushes, have small scaly flowers, but as the perianth is always whorled, or in the shape of a flower, the name Floridæ remains highly appropriate.

The Floridæ include the brightest ornaments

of the monocotyledonous class. They boast as members, the fantastic Orchids, which, defying all rules of floral propriety, mock the animal world, and sport and revel in every variety of grotesque form ; the gorgeous and elegant Lilies, and the stately Palms. To come nearer home, they appeal to our hearts with the pale Snowdrop, gladdening us with the first token of reviving life, as the sun begins his return to us from distant Capricorn ; and the glowing Crocus, seeming to present to us, amid Winter's ice, a dream of the golden Midsummer in its rich and burning hues.

Examples of the sub-class Floridæ, or Petaloidæ—Orchis, Lily, Iris, Crocus, Snowdrop, Hyacinth, Gladiolus, Narcissus, Daffodil, Rushes, Arum, Palms.

The third sub-class of Monocotyledonous plants has flowers strikingly different from those of the last class. Instead of gaily coloured petals, the floral envelope consists of small, dry, pointed *scales*, called *glumes*. Each floret has

two glumes, they are set one inside another, and the glumes of one floret overlap those of its neighbour, like the slates of a house. This mode of construction is termed *imbricated,* it is also seen in the scales of a Fir Cone and in the buds of a Horse Chesnut. The imbricated florets in the plants now under consideration are packed into little spikes, or spikelets, as they are termed; these spikelets may be combined into a large dense spike, as in an ear of Wheat, or into a loose panicle, as in Oats, and many kinds of branching Grass.

From the dry pointed scales, or glumes, which form its floral envelope, the third sub-class of Endogens has been named *Glumiferæ*— that is, glume-bearing. It is defined as consisting of plants having leaves with parallel veins, and the perianth scale-like and *imbricated.* It contains but two natural orders, the Carex, or Sedge tribe, and the Grasses. But though the flowers are small and inconspicuous, we must not despise the Glumiferæ. When it is remembered that the animals we consume derive the

greatest proportion of their nourishment from grasses, and that corn, rice, maize, and grain of all kinds, are yielded by plants of this tribe, it will be allowed that we do not overstate the case in asserting that it is on the sub-class Glumiferæ that we mainly depend for our supply of food.

Examples of the sub-class — Sedges and Grasses.

Recapitulation of the sub-classes of Monocotyledonous plants:

Sub-class 1. Dictyogenæ. Plants having leaves with *netted veins,* and flowers with the perianth whorled.

Sub-class 2. Floridæ, or Petaloidæ. Plants having leaves with parallel veins, and flowers with the perianth whorled.

Sub-class 3. Glumiferæ. Plants having leaves with parallel veins, and flowers with the perianth scale-like and *imbricated.*

Into these seven sub-classes, four of Dicotyledons, or Exogens, and three of Monocotyledons,

or Endogens, all flowering plants are divided. The marks of distinction are clear and obvious, and, with patience and care, there can be no difficulty in referring to its appropriate class and sub-class, every plant the beginner may meet with, which has flowers large enough to be conveniently examined. It will prove an interesting and instructive study to go into the fields or garden, and, bringing in a handful of common flowers, endeavour to discover to which class and sub-class each plant belongs. In order to do this, it is not necessary to know the name of a single plant examined, and when it can be accomplished with readiness and accuracy, the student will have laid a firm foundation for a systematic study of Botany.

He will indeed be further advanced in the science than many an one, who, able perhaps to repeat the botanical names of hundreds of plants, may yet remain ignorant of the grand principles of classification.

## CHAPTER IV.

THE sub-classes each include numerous tribes, or *Natural Orders*, the Natural Orders may each include numerous *Genera*, the Genera may each include numerous *Species*.

It does not enter into our present plan to examine in detail the distinctions on which all these groups are founded, but merely to give a general explanation of the meaning of the terms. To do this in the clearest manner we will begin with the last term, *Species*.

The word Species may be roughly interpreted to mean, kind, or sort, of plant. When we sow the seeds of any plant, we confidently expect that they will produce young plants of the same sort as the plant which bore the seed.

Suppose the seed sown to be that of the com-

mon Scarlet Poppy of our corn-fields, we may be quite sure that the young plants will turn out to be Poppies, and Scarlet Poppies too. The common Red Poppy (Papaver Rhœas) has deep scarlet petals, with a black spot at their base, a smooth, nearly globular seed vessel, and hairy stems. Another kind of Poppy, also common in corn-fields (Papaver dubium), has pale scarlet petals, an elongated or club-shaped seed vessel, and hairy stems. Another kind, very different from the two last, the White Poppy (Papaver somniferum), has large whitish flowers and smooth stems. These peculiarities are perpetuated from generation to generation; we never find the seed of the White Poppy producing young plants of the Corn Poppy, nor *vice versâ*.

It may therefore be assumed that all the individuals of a species have descended from some single individual possessing the characteristic marks.

Thus all the plants of the common Red

Poppy, (Papaver Rhœas) owe their origin to a single plant, having deep scarlet petals, a rounded capsule, and hairy stems. All existing plants of the Pale Poppy are descended from a plant possessing pale scarlet petals, an elongated or club-shaped capsule, and hairy stems. All plants of the White Poppy spring from one having large whitish flowers and smooth stems.

How the original progenitors of the several species came into being, is a question which the wise men have not yet fully settled, and which does not concern us now. All that we need note at present, is, that we apply the term *Species* to all those individual plants which are sufficiently alike to induce the belief that they may all have originated from seeds of the same plant.

We have noticed three kinds of plants, differing from each other by well-marked peculiarities, yet sufficiently similar in general character to make us unhesitatingly call all three kinds *Poppies.* We have the

Scarlet Poppy,

Pale Scarlet Poppy,
White Poppy.

The botanical name for Poppy is *Papaver*, and the three kinds are named in botanical language respectively—

Papaver Rhœas,
Papaver dubium,
Papaver somniferum.

The three *kinds* of *Poppy* are three *Species* of the *Genus Papaver.*

They may be compared to brothers and sisters in a family, who each bear the family name in addition to his own special name. The name of the Species answers to the Christian or individual name, that of the Genus answers to the surname or family name. But plants bear their surnames first. Thus, if we were to enumerate the Smith family in botanical fashion, we might say that it consisted of

Smith John,
Smith Thomas,
Smith Mary,

and so on.

Let us take another instance of species grouped into a genus. The genus Viola, or Violet, contains several species, of which the most common are

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|---|---|
| Viola odorata. . . | Sweet Violet. |
| Viola canina . . . | Dog Violet. |
| Viola tricolor. . . | Pansy Violet. |

These species resemble each other sufficiently to make us call them all Violets, yet they differ so much as to require separate names. We give to them all the generic or family name, Violet, and to each member a specific or individual name to distinguish it from the others.

We repeat that species in a genus resemble brothers and sisters in a family, who each bear the family name in addition to his own. All plants have a specific and a generic name, though there may be only one species in the genus, as every person has a Christian and surname, though he may be the only child in the family.

Genera, which resembles each other to a

greater or less degree, are grouped together into tribes, or *Natural Orders.* The Genera are to a Natural Order much what species are to a genus, but they are not so closely related. If the species in a genus resemble brothers and sisters in a family, the genera in a Natural Order may be compared to cousins, more or less distant. The Natural Orders are usually named after some one of the included genera—thus the Natural Order, to which the Poppy belongs, is called *Papaveraceæ*, or the Poppy tribe. It consists of plants with flowers formed on the same general plan as those of the Poppy, —that is, having two sepals, four petals, numerous stamens, and a free seed vessel with numerous seeds,—but which certainly are not Poppies.

Examples of such plants are the greater Celandine (Chelidonium majus) and the common garden annual, Eschscholtzia Californica.

The Natural Orders are grouped into the sub-classes before described.

If now we take an individual plant of the

common Scarlet Poppy, we see that it belongs to the

| | |
|---|---|
| Class . . . | Dicotyledons, |
| Sub-class . . | Thalamifloræ, |
| Natural Order | Papaveraceæ, |
| Genus . . . | Papaver, |
| Species . . | Rhœas. |

In other words, the species Papaver Rhœas belongs to the Natural Order Papaveraceæ, and the first sub-class Thalamifloræ of the first class of flowering plants Dicotyledons, or Exogens.

It does not enter into our present plan to go into a detailed examination of the points which define the Natural Order, genus, and species of the plant in question. These are found in such works as Professor Babington's "Manual of British Botany," but the reader of this little work ought to be able to determine the class and sub-class of any plant in flower that he has carefully examined. He will then be able, on taking up a Manual of Botany arranged on the Natural System, to turn at once to the part of

the book where he must look for a description of the plant in detail.

Happy shall I be if I have led any who may have followed me to the end of our present journey to pursue the path thus indicated, and to taste the ever-increasing pleasures and wonders with which the Creator rewards those who diligently seek to understand His works.

THE END.

# GLOSSARY AND INDEX.

Crossley and Billington, Printers, Rugby.